expand often in the form of a flat growth along the floor of the middle fossa, occasionally invading the orbit, the sella turcica or even the posterior fossa.

Since the first operation by Krogius,[5] in 1895, there have been reported, including my own, 13 cases of tumor of the Gasserian ganglion which have been exposed at operation; of this number 10 were large inoperable growths and the death-rate was high. In but 3 cases was the tumor operable in the sense that it could be completely removed. These were the cases of Berg, Sachs and the author. In the case of Sachs and Berg a burning sensation had been experienced eleven months prior to operation. A large endothelioma, involving the entire ganglion and all its branches, was exposed and removed. The patient made a good recovery and two months after the operation was free from pain and complained of nothing save loss of taste on the left side.

In the writer's case the operation was performed within three months of the first symptom. The patient was seen fifteen months after the operation and, apart from certain paresthesias, which might well have been due to avulsion of the sensory root, there were no signs of recurrence.

In those 3 cases in which the tumor was strictly within operable limits there were no operative fatalities. On the other hand, when a radical operation was ambitiously but unwisely attempted the results were in most instances disastrous. When the lesion has advanced beyond the point where an attempt at removal can be made with propriety one should not shrink from operation, if only as a measure of temporary relief. To this end avulsion of the sensory root for the relief of pain or subtemporal decompression for the relief of pressure may give the patient a respite for which he may be most grateful.

SAHLI'S VOLUME SPHYGMOBOLOMETER: A RECENT IMPROVEMENT OVER THE OLDER PRESSURE SPHYGMOBOLOMETER.[1]

By NATHANIEL BOWDITCH POTTER, M.D.

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ENDEAVORING to improve the latest modification of his sphygmo-bolometer, to simplify the entire procedure and to further the clinical

⁵ Revue de Chir., 1896, xvi, 434.
¹ Cf. Potter, N. B.: Jour. Am. Med. Assn., April 19, 1913, p. 1211.

applicability of this dynamic method of studying the pulse, Sahli has recently introduced[2] the volumesphygmobolometer (volumebolometer) as distinguished from the pressuresphygmobolometer (pressurebolometer). The latter directly estimates the *pulse work* (*arbeit*), whereas the new instrument measures the *pulse volume* and only indirectly, with the aid of a simple table, the *pulse work*. After many months' experience with this latest model, including a careful comparison with the former (pressurebolometer), the writer has become entirely convinced of its superiority, both in simplicity and accuracy. Many of the defects and drawbacks of the pressure instrument[3] have been obviated or at least minimized, and the determination of the *pulse volume* and *work* has been made so simple that the distinguished clinician's plea for a more general utilization of the instrument and method in the study of pulse dynamics seems well worth echoing in America. It is outside the scope of this communication to discuss the clinical utility of the determinations revealed by this method, or to more than once more mention Sahli's apt contrast between them as *dynamic* and blood-pressure figures as *static* estimations, to attempt to estimate the horse-power of a locomotive from the measurement of the steam pressure in the boiler. In what follows the writer will merely describe the volumebolometer and its application, and in order to justify the entire method, enumerate a few values obtained with the old as contrasted with the new instrument.

The new apparatus, coupled together, is represented in the following cut:
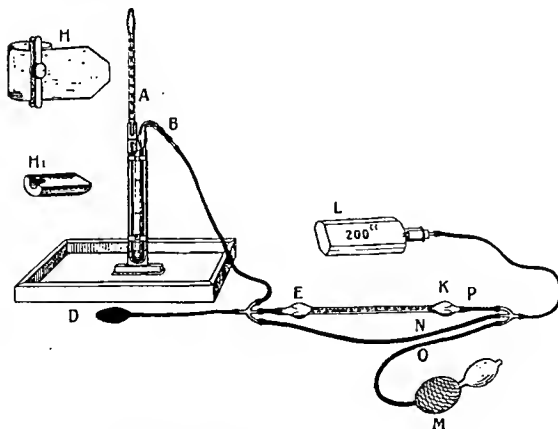
It consists of two parts: Sahli's pocket mercury manometer (1914 model, *AB*), simplified by the omission of the caliber narrowing or throttling at the bend of the U-tube, and the same cuff (*II*), hard-rubber plate (*II₁*), pelotte (*D*), connecting tubing with a double rubber bulb (*M*) instead of the syringe, and a modified index manometer (*EK*). The latter, an index volumeter, alone requires description. Terminating in ampullæ open at each end (*E* and *K*) the capillary tube, with a large bore, is plainly divided into much longer subdivisions than the mercury manometer. It contains about 0.2 c.c. colored petroleum, indicating not linear centimeters but hundredths of cubic centimeters. The pelotte is applied flat and empty, as with the older instrument, and without any pressure in the system. By means of two triple Y-glass connections, and the same accurately calibrated, stiff rubber tubing (1.5 mm. in diameter), one ampulla (*E*) is coupled to the mercury manometer (*A*); to the pelotte (*B*) and with flexible tubing to its fellow ampulla (*K*); the other (*K*) to a 200 c.c. empty bottle (*L*) fitted with a perforated rubber stopper and glass tube; with soft compressible rubber tubing to a double rubber bulb (*M*) and to its fellow ampulla (*E*). Inflation of the bulb increases the system's pressure but slowly because of the inclusion of the relatively large air space in the bottle, and does not affect the position of the colored index in the capillary tube because of the free communication of the two terminating ampullæ by the compressible tube (*N*). After application of the pelotte to the radial artery in the usual way and the introduction of a sufficient pressure in the system the index will begin to pulsate as soon as this latter tube is tightly compressed by the finger of the examiner, thus excluding the large air space of the reservoir and limiting the action of the pulse to that portion of the space to the left of the index. With an open tube (*N*), tipping the index manometer will readily depress the colored index by gravity and so enable the examiner to collect and form the index at or near the middle of the manometer. Just where this is does not matter, but if the index is too long some of the petroleum can be quickly returned to one of the two ampullæ by gravity flow, and if "split" into several indices, though this is of no special disadvantage, the superfluous smaller ones emptied into an ampulla in the same simple fashion. It is also very easy to destroy the index if it is desirable to form another. This is done by raising the manometer to a vertical or oblique position, pinching the tube (*N*) and gently pumping with the bulb. To release the pressure from the system the rubber stopper is withdrawn from the bottle, although the practically constant leaking of the bulb is usually sufficient. To avoid bursting or unduly distending the delicate rubber of the pelotte, no pressure should be exerted in the system until after the snug application of plate and cuff on the wrist. The same rules for testing the impermeability of the system as applied to the older method hold good for this apparatus, but are much less essential

because inflation of the bulb will quickly correct any leakage of air,
and the results in volumebolometry are independent of the volume
of the contained air.

DIRECT ESTIMATION OF THE VOLUME (V) OF THE "OPTIMAL
DAMMEN" PULSE (THE CLINICAL "PULSE VOLUME") (Grösse).
After applying the pelotte to the radial artery, securing it in posi-
tion there firmly, establishing the index and inflating with the bulb
until enough pressure exists in the system to evoke a pulsation of
the index, this pressure is read upon the mercury manometer. Each
further increase of pressure is accompanied by pinching the two
flexible rubber tubes at N and at O in order to judge the size of the
pulsations of the index. If the latter is dislocated along the capil-
lary tube a leak exists upon the side of the system toward which it
moves and should be corrected. As the pressure in the system is
gradually increased the pulsations lengthen, then remain for a time
equal and finally diminish. The *optimal pressure* corresponds to the
pressure in the mercury manometer just before which these pulsa-
tions begin to diminish again in size: in other words, the point at
which the energy of the pulse beats is most completely transmitted
through the system. The pulsations of the index are then read
off the subdivisions of the capillary tube in hundredths of cubic
centimeters. As stated above the relative position of the pulsating
index in the capillary tube is of no import.

Just as with *pressurebolometry* one can advantageously control
the measurement by now repeating it backward, so to speak, *i. e.*,
by overstepping the point of maximum pulsation, allowing the
pressure in the system to slowly decrease by means of the gradual
leaking of the bulb and connections until a point is noted at which
the excursions suddenly begin to once more increase. This is again
the *optimal pressure.*

These excursions at optimal pressure are an absolute measure
(hundredths cubic centimeters) *of the volume of the optimally dammed
pulse;* in other words, what we have always been accustomed to
roughly estimate with the palpating finger and speak of as the size
(grösse) of the pulse. This is of course merely a relative measure-
ment of the size of the circulation based upon the pulse in that por-
tion of the radial artery included under the inflated pelotte.[4]   In
estimating the size of the circulation, *pulse frequency* must of course
be considered as well.

The detail to be remembered before reading the index is always
to exclude the bulb from the system by pinching the tube at O
as well as at N, otherwise the excursions would not exactly equal
the volume of the dammed pulse.

Now these excursions which measure the dammed pulse are quite
large and very striking, may even attain several centimeters in length,

and hence may be exceedingly rapid, so that sometimes an irregular movement or shaking results and produces the impression of too large a pulse volume. This is readily detected by noting that the meniscus of the index does not pause for an instant at the point at which the index is read but exhibits vibrating individual movements. To prevent this the index is shortened to 1 cm. or less by allowing part of it to flow into one of the ampullæ.

ESTIMATION OF THE PULSE WORK (ARBEIT). The *work* (*A*) is reckoned according to the following formula:

$A = V \times P \times 13.6$ gram centimeters in which:

A = work,

V = volume of the dammed pulse expressed in cubic centimeters.

P = optimal pressure expressed in cubic centimeters Hg.

13.6 = specific gravity of mercury.

The accompanying table will facilitate this computation: .

P. (cm. Hg.)	P. × 13.6	P. (cm. Hg.)	P. × 13.6.	P. (cm. Hg.)	P. × 13.6.
1	13.6	11	149.6	21	285.6
2	27.2	12	163.2	22	299.2
3	40.8	13	176.8	23	312.8
4	54.4	14	190.4	24	326.4
5	68.0	15	204.0	25	240.0
6	81.6	16	217.6	26	353.6
7	95.2	17	231.2	27	367.2
8	108.8	18	244.8	28	380.8
9	122.4	19	258.4	29	394.4
10	136.0	20	272.0	30	408.0

THE SUPERIORITY OF VOLUMEBOLOMETRY TO PRESSUREBOLOMETRY. As contrasted with the pressurebolometric equations the barometric pressure is entirely disregarded in volumebolometry, an advantage when employing this clinical method at elevations above 3000 feet. Another advantage is that the values are much less dependent upon an optimal application of the cuff, since in virtue of the large air space the increase of pressure in the system to produce the pulsations is a minimal one. It is advisable, however, even with this method, to secure an optimal cuff application, but this is accomplished by comparatively moderate tension of the cuff.

THE DIAGNOSIS OF CHRONIC APPENDICITIS.[1]

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THE recognition of chronic appendicitis presents many difficulties: on the one hand because its own manifestations are so variable,

[1] Read before the Nevada State Medical Society, at Reno, Nevada.